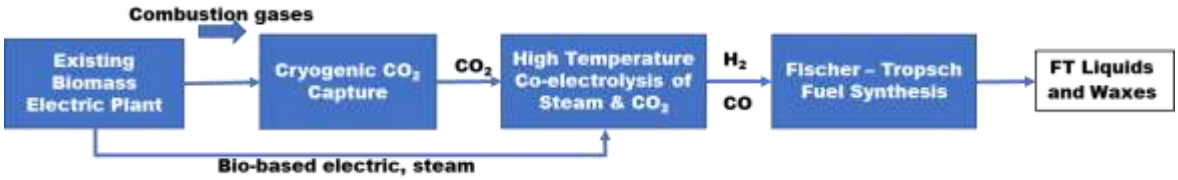
Project Summary / Abstract

PI: Joseph Hartvigsen Control #: 2029-1526

OxEon Energy, NOVO Power (NOVO), and Sustainable Energy Systems (SES) have teamed for a proposed project titled "*Production of Liquid Hydrocarbons from Biomass Generated Carbon Dioxide*" to demonstrate at engineering-scale the capture and conversion of biomass combustion product CO_2 to liquid hydrocarbons (HC). The proposed project will capture bio-CO_2 produced at the electric power plant operated by NOVO using cryogenic capture technology developed by SES and convert the pure CO_2 stream and steam (generated by the NOVO power plant) into HC. OxEon's high temperature solid oxide co-electrolysis (HTCE) will be used to convert the CO_2 – steam to synthesis gas (CO, H_2), which will then be converted to HC using an OxEon Fischer Tropsch (FT) reactor design. Each of the technology components have been field tested independently and will be combined for the first time in this project.

NOVO currently operates a 27 MWe electric power plant in Snowflake, AZ using waste wood supplied under long term agreement with the US Forest Service as feedstock to a circulating fluid bed boiler. Currently, the power is sold to Arizona Public Service and Salt River Project under an IPP arrangement. The CO_2 from the boiler is emitted to the atmosphere under existing permits. The power sales agreement will be expiring in the next few years and may not be renewed. Thus, NOVO is interested in exploring alternatives for continued operation of the facility. The continued operation would maintain jobs in the local community, provide beneficial use of the waste wood, and has the potential to produce bio-based HC to replace petroleum-based fuels. The specific proposed engineering level demonstration concept is shown in Figure 1.

Figure 1: Process flow for Production of Liquid HC at NOVO Power Biomass Electric Plant



For this project, a portion of the CO_2 currently emitted by the wood-fired boiler will be captured using a cryogenic capture system developed by SES. SES has a mobile demonstration system capable of capturing up to one (1) ton per day of CO_2 from the combustion gases emitted from a boiler and this unit will be deployed to the Novo Power site. The efficiency of this capture system has previously been shown to be superior to other potential capture methods. The CO_2 will be fed to an OxEon 20 kW HTCE system where the CO_2 and steam from the NOVO electric plant will be converted to synthesis gas using biomass generated electricity. The synthesis gas will be passed to an OxEon FT system capable of producing ~8 gallons per day of operation. It is expected that the HTCE system and FT reactor system will operate for at least 500 hours and will generate in excess of 100 gallons of synthetic hydrocarbons.

OxEon HTCE stacks have been supplied to Jet Propulsion Laboratory (NASA) for experimental operation on the Curiosity Class Rover that will be launched to Mars in 2020 and to Idaho National Laboratory in association with one of their research programs. The OxEon FT system is a fixed bed system that has been run for extended periods of time in association of a pilot gas-to-liquids plant at its site in Utah. OxEon has built modular FT reactors that have been supplied to a university, a company in China, and the US Department of Energy.